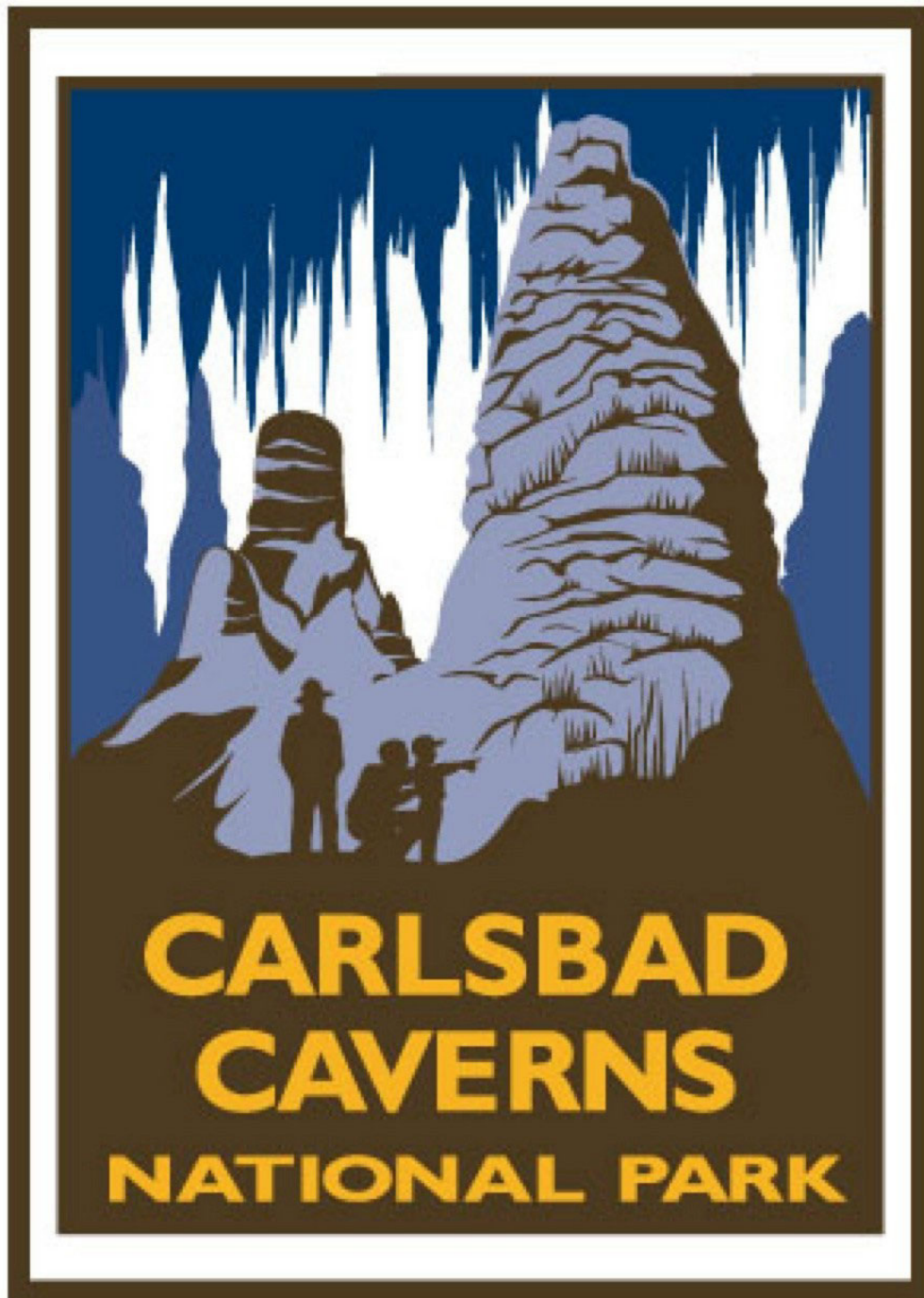


Caves, Canyons, Cactus & Critters

A curriculum and activity guide for Carlsbad Caverns National Park



Middle School Geology



Caves, Canyons, Cactus & Critters

Geology Curriculum

I. Introduction	1
A. Purpose of the curriculum	1
B. Format of the Curriculum	2
C. Suggestions for trips to accompany this curriculum.....	4
II. Activity Units	
C. Surf Carlsbad! Activities related to the development of the Delaware Basin and Capitan Reef.....	5
1. A House Made of Sponge? Game introducing the various organisms believed to have formed the Capitan Reef.	6
2. Old Salts Activity designed to demonstrate the precipitation and sedimentation of salts in the Delaware Basin.....	11
3. Is it Limestone, or Did I Get Gyped? Activity to introduce the main Permian Age rocks found in the Carlsbad Caverns National Park Area and the minerals they are made of; limestone, gypsum, halite, sandstone, shale. (A very basic mineralogy and petrology lab.)	14
4. Meet My Pet Fossil, Rocky Activity in which students make plaster-of-Paris fossils and then study a real fossil; describing it, its environment, what and how it ate, etc.	19
B. Wandering Continents A study of plate tectonics.....	23
1. Apples, Eggs, and the Earth An activity designed to present information on the layers of the Earth.	24
2. Come Visit Me In Tropical... Antarctica? Activity in which the supercontinent of Pangea is reconstructed using modern continents, imagination, and a little help.	27
C. Clams Got Wings! An exploration of uplift and mountain building.	31
1. You're stressing me out! Activities designed to demonstrate stresses in the Earth's crust.	32
2. Achy Breaky Earth Students will build cardboard or clay models demonstrating the three major types of faults and the three major types of folds.	34

D. Oil Munchers	Activities exploring the role of anaerobic bacteria in the formation of caves in Carlsbad Caverns National Park.....	39
1. It's More Than Just Dead Dinosaurs	An activity designed to model oil and gas formation and traps.	40
2. Strange Things in Strange Places	An activity to explore bacteria that live in strange places (underground anaerobes, Lechuguilla Cave, thermal springs, Mars).....	45
3. Stinky Gas and Alabaster	An activity to demonstrate gypsum replacement of limestone in the formation of the caves of the Guadalupe.....	48
E. Mother Nature's Gravel Company	Activities designed to introduce the topics of weathering and erosion.	52
1. Ice Wedgies!	An activity designed to study the effect of freeze/thaw cycles on rock.	53
2. Huff 'n' Puff	A lab designed to study the effect of obstacles on sand dune migration.....	55
3. Flash Flood Fantasy	A lab that demonstrates the effects of erosion and deposition in the Basin and Range region of the US southwest.	59
4. Nature's Acids	A look at how natural acids contribute to cave formation.	62
F. Hangy Downys, Sticky Upys, and Other Pretty Cave Decorations	Activities that explore the origin of various cave formations.	65
1. Hangy Downys and Sticky Upys	An activity to grow stalactites and stalagmites.	66
2. Not Just Your Average Decoration	A look at other special cave decorations (cave pearls, popcorn, corrosion features, etc.).....	70
3. It's a Small World	A look at microclimates.....	73
4. Drip, Drip, Drip	A study of infiltration and water chemistry.....	78
5. A River Runs Through It... Literally!	A look at another manner in which caves can form.....	82
III. State Standard/Benchmarks	85
IV. Glossary	92
V. Suggested Resources	97



Introduction

A. Purpose of the Curriculum

Even without its spectacularly decorated caves, Carlsbad Caverns National Park would still be a special place to geologists. It is a world-class site in which to study ancient reef environments and had contributed greatly to our knowledge of carbonate shelf structures. When the caves of the park are added in, it creates a location second to none in the unique beauty of its surface and the mystery of its depths.

This curriculum is designed to assist the middle school teacher who wants to introduce some of the special geology of Carlsbad Caverns National Park to their students. While a background in geology is helpful, it is not a prerequisite. By studying the background material provided and doing a little library and Internet research, most teachers should be able to comfortably teach the lessons contained here.

On the following pages, I have included a description of the lesson format and suggestions of fieldtrips to take to Carlsbad Caverns National Park. Please read these prior to using this curriculum. Hopefully they will give you more insight into the author's intent and the manner in which this guide was written.

B. Format of the Curriculum

The curriculum is broken into six units. Each unit has an opening page in which the topic of that unit is discussed. Each of the lessons is then written in the following format:



Lesson Title

Brief description of the lesson that can be used as an opening query for your students.

Summary: Brief summary of what the lesson will cover.

Duration: Estimated duration of the lesson and activity. Your mileage may vary.

Setting: Most are done in a classroom or lab, but some are also messy. This tells where you may want to do the activity.

Vocabulary: Key vocabulary words are listed here and defined in the glossary.

Standards/Benchmarks Addressed: State standards and benchmarks are keyed to the standard and benchmark section at the back of the curriculum.

Objectives

Students will:

- objectives of the lesson are listed here.

Materials

Materials needed for demonstrations, the lesson, or activities are listed here.

Background

This section contains enough background material to get you through the lesson. You may want to do your own background research, as well.

Procedure

Warm up: This section describes some possible opening activities to focus students on the topic of the lesson.

Activity

1. This is a detailed description of the activity.
2. Unlike many chemistry labs, you are allowed to experiment outside the bounds!!
3. Use these activities as an opportunity to explore with your students.
4. If they ask, "What if..." feel free to modify the procedure to try to answer their questions.
5. DO NOT STRESS OUT!!
6. HAVE FUN!!

Wrap Up: This section contains suggested discussion topics and activities to bring closure to the lesson.

Assessment

Have students:



- Do something to prove that they have learned.
- These are only suggestions.
- You know your students. Modify the assessment to meet the needs of your class.

Extensions

These are other activities that you might want to do to extend the lesson or to allow your students to continue to explore.

Resources

These are the resources used in writing the background material and contain valuable information. Some are very easy to follow, others are quite technical.

But there are many more resources than those listed here. The most valuable resource is people. The National Park Service, the Bureau of Land Management, the Forest Service, and Soil and Water Conservation Service, your county extension office and many local businesses all have people who can help. Most would welcome the opportunity to speak to your students. Contact them.

C. Suggestions for trips to accompany this curriculum.

During a regular tour of Carlsbad Cavern, or a tour of Spider Cave or Slaughter Canyon Cave, have students look for the following features. Lessons from this curriculum that describe the features have been listed as well.

1. speleothems such as stalactites, stalagmites, and columns and features such as joints, or cracks in the bedrock, that control their growth – *Hangy Downys and Sticky Upys; Nature's Acids*
2. directional speleothems – *Not Just Your Average Decoration*
3. evidence of microclimates – *It's a Small World*
4. fossils – *Meet My Pet Fossil, Rocky*
5. gypsum – *Stinky Gas and Alabaster*

Hike up Slaughter Canyon in Carlsbad Caverns National Park or McKittrick Canyon in Guadalupe Mountains National Park. Point out and discuss the rock features seen on the canyon walls. Among these should be the massive Capitan Reef formation that forms the large, tan cliffs in the canyon. This was part of the main reef. Also, pay attention to the horizontal layers that begin up the canyon and end at one of the cliffs or near the edge of the escarpment. These are the backreef layers. They were deposited in the lagoon between the reef and the shore. Have the students look for fossils and try to describe what organism may have formed them. Have students look for evidence of joints, or vertical cracks, in the hillsides. Also, have students look for and describe evidence of weathering and erosion. – *A House Made of...Sponge?; Is it Limestone, or Did I Get Gyped?; Meet My Pet Fossil, Rocky; You're Stressing Me Out!; Achy Breaky Earth; Ice Wedgies!; Flash Flood Fantasy*

While at the Carlsbad Cavern National Park visitor center, walk to the edge of the escarpment and point out and discuss the following with the students:

1. The escarpment parallels the basin-ward side of the ancient reef. The slope of the escarpment is probably similar to the actual slope of the ancient reef. – *A House Made of...Sponge?*
2. The flats you are looking on are full of basin deposits, formed in the ancient basin. – *Old Salts; Is it Limestone or Did I Get Gyped?*
3. The light colored areas in the basin are probably gypsum, one of the rocks deposited in the ancient reef. – *Old Salts*
4. Look for evidence of joints and horizontal layers. If they are not readily visible in the rock, look for lines of dark green vegetation. Plants will grow along joints or the boundaries between layers due to the water stored in those features. – *You're Stressing Me Out!; Achy Breaky Earth; Drip, Drip, Drip*